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ADJUSTABLE FENCE FOR COMPOUND MITER SAW

Cross Reference to Related Applications

This application is a continuation of U.S. application Serial No. 09/163,896 filed
5 October 1, 1998, which is a continuation of U.S. application Serial No. 08/600,907 filed
February 13, 1996, which is a continuation of U.S. application Serial No. 08/329,766
filed October 27, 1994 (now abandoned), which is a continuation of U.S. application
Serial No. 08/088,266 filed July 7, 1993 (now abandoned), which is a continuation of
U.S. application Serial No. 07/774,767 filed October 9, 1991 (now abandoned), and a
10 continuation-in-part of U.S. application Serial No. 07/774,022 filed October 9, 1991, now
U.S. Patent No. 5,297,463, issued March 29, 1994.

Background and Summary of the Invention

The present invention relates generally to compound miter saws, or other power
15 operated equipment or machinery. More particularly, the invention relates to
improvements in an adjustable fence for such power-operated equipment, with the
fence assembly having a fixed fence portion and a movable fence portion for selectively
adjusting the gap between the fixed and movable fence portions in order to allow
sufficient clearance for performing various operations on a workpiece when the
20 equipment is in any of a number of different cutting or working modes.

Saws and other apparatuses designed for cutting or performing other working
operations on a workpiece typically require a workpiece-supporting fence assembly in
order to support and locate the workpiece in a proper fixed position for performing the
working operation. Examples of such equipment include compound miter saws, which
25 are adapted for allowing the user to selectively move the saw blade into any of a

number or positions or modes for square cutting, miter cutting, bevel cutting, or compound cutting where a combination miter and bevel are cut. In addition, some operations, such as dado cutting or shaping operations, for example, require the use of saw blades or other cutting or working devices of different shapes or sizes to be substituted for one another in order to perform the desired operation on the workpiece, whether the workpiece is composed of wood, plastic, metal, or other materials.

In order to accommodate these widely varied working operations, the workpiece-supporting fence is frequently required to be at least partially adjustable in order to selectively vary the gap or space between a fixed and a movable portion of the workpiece-supporting fence, thus selectively providing clearance for the saw blade, cutter, or other device performing the working operation on the workpiece. If such adjustability were not provided, a relatively large permanent gap would have to be provided between portions of the fence in order to accommodate the widely varying range of movement, position, or size of the saw blade, cutter, or other working device. Thus, in order to provide adequate workpiece support when performing operations that do not require such large clearance, the above mentioned adjustable fence assemblies, having at least one movable fence portion, have frequently been provided.

In order to address the above-discussed problems associated with the provision of a fence assembly having an adjustable clearance gap, a variety of fence-adjusting arrangements have previously been provided. However, many of such prior fence-adjusting arrangements have suffered various disadvantages, including difficulty in maintaining proper alignment between the relatively movable fence portions in wide-gap positions, inconvenience in performing fence adjustment operations, the possibility of inadvertently misplacing a removable fence portion, lack of adequate support for relatively tall or thick workpieces, or other similar disadvantages. Thus, the need has arisen for an adjustable fence for compound miter saws, or other power equipment

requiring fence adjustability, which overcomes these disadvantages, as well as providing improved ease of operation, economy in manufacturing, and other advantages that will become readily apparent to those skilled in the art from the discussion below.

In accordance with the present invention, an improved adjustable workpiece-
5 supporting fence assembly includes a fixed fence portion fixedly interconnected with the base of the device in which it is employed, with the fixed fence portion being disposed on one side of the saw blade, the workpiece cutter, or other such device for performing a working operation on a workpiece. A movable fence portion is selectively and laterally movably interconnected with the frame on the opposite side of the work-performing
10 blade or cutter and is laterally spaced from the fixed fence portion. The base or other portion of the device in one preferred form of the invention includes a fence-supporting portion fixedly disposed on the same opposite side of the blade or cutter, with a laterally-extending slot formed therein. The slot, which preferably has spaced opposite internal walls therein, is adapted to receive a laterally-extending tongue portion of the
15 movable fence, with the tongue being slidably received within the slot for selective adjustable lateral movement of the movable fence toward and away from the fixed fence.

In such preferred embodiments of the present invention, a fixed clamping arrangement is interconnected with the fixed fence-supporting portion for releasably and
20 clampingly urging the tongue on the movable fence portion against a first of the slot's internal walls at any of a number of adjusted positions therein. In addition, a movable clamping arrangement is fixedly interconnected with the movable fence portion for movement therewith and is adapted for releasably and clampingly urging the tongue portion against the same first internal wall of the slot at any number of the adjusted
25 positions. Preferably, the fixed and movable clamping mechanisms are located to provide the greatest possible lateral spacing therebetween, and thus the maximum

alignment and stability, when the movable fence portion is adjusted to a position wherein the lateral spacing or gap between the fixed and movable fence portion is at its minimum.

In order to accomplish the above arrangement, the preferred movable clamping
5 mechanism includes a clamping plate pivotally interconnected with the movable fence
portion and having an abutment portion pivotally movable into and out of clamping
engagement with the second, opposite internal wall portion of the slot. Such pivotal
movement of the clamping plate abutment portion into clamping engagement with the
opposite internal wall portion of the slot causes a reactive force that clampingly urges
10 the tongue portion of the movable fence against the first internal wall portion of the slot.
This arrangement adjustably secures the movable fence portion at any of a number of
selectively adjustable lateral positions relative to the fixed fence portion, regardless of
the size of the fence clearance gap.

In addition, the preferred embodiments of the present invention also include a
15 raised portion of the movable fence, with such raised portion being configured to
interferingly engage with the saw blade assembly and guard, or other such movable
work performing device, without inadvertently damaging the movable fence in order to
alert the operator that the movable fence has not been properly adjusted for the
workpiece cutting or forming operation being attempted. Such raised portion of the
20 movable fence, as well as a similar raised portion of the fixed fence portion, provides
a significant advantage when cutting or working thicker or taller workpieces.

Additional objects, advantages, and features of the present invention will
become apparent from the following description and the appended claims, taken in
conjunction with the accompanying drawings.

25

Brief Description of the Drawings

In the drawings which illustrate the best mode presently contemplated for carrying out the present invention:

Figure 1 is a front perspective view of an exemplary compound miter saw
5 according to the present invention.

Figure 2 is a front elevational view of the compound miter saw of Figure 1.

Figure 3 is a rear elevational view of the compound miter saw of Figures 1 and
2.

Figure 4 is a left and elevational view of the compound miter saw of Figures 1
10 through 3.

Figure 5 is a schematic plan view diagram of the compound miter saw of Figures
1 through 4, schematically illustrating the position of the saw blade relative to the
workpiece-supporting fence in both a straight cross-cut position and in a miter-cutting
position.

Figure 6 is a schematic diagram, similar to that of Figure 5, but shown in an
15 elevational view and illustrating the position of the saw blade relative to the workpiece
supporting fence when in both a straight cross-cut position and in a bevel-cutting
position.

Figure 6A is a schematic diagram, looking from the rear of the saw, depicting the
20 fully extended and fully retracted positions of a movable portion of the work-supporting
fence.

Figure 7 is a partial cross-sectional view of the work-supporting fence of the
exemplary compound miter saw illustrated in Figures 1 through 4, taken generally along
line 7-7 of Figure 2.

Figure 8 is a cross-sectional view similar to that of Figure 7, but taken generally
25 along line 8-8 of Figure 2.

Figure 9 is a schematic illustration of the preferred interfering relationship of the saw blade guard with the movable portion of the work-supporting fence assembly for alerting the operator that the movable portion of the fence assembly has not been properly adjusted for the operation being performed.

5 Figure 10 is a schematic representation illustrating the provision of a movable portion of the fence assembly on each lateral side of an exemplary compound miter saw.

Detailed Description of the Preferred Embodiment

10 Referring now to the drawings in which like reference numerals designate like or corresponding parts throughout the several views, Figures 1 through 10 illustrate an exemplary compound miter saw having an adjustable fence assembly according to the present invention, shown merely for purposes of illustration. One skilled in the art will readily recognize from the following description, taken in conjunction with the

15 accompanying drawings and claims, that the principles of the invention are equally applicable to compound miter saws or saws of types other than that shown for purposes of illustration in the drawings. Similarly, one skilled in the art will readily recognize that the principles of an adjustable fence according to the invention are also applicable to

20 other types of powered, or even unpowered, equipment for performing an operation on a workpiece. Such equipment includes non-compound miter saws, dado saws, spindle shapers or sanders, or other types of powered or unpowered devices that require selective adjustment of the gap or spacing in the fence assembly in order to accommodate different sizes or positions of tooling, or to perform various different workpiece working operations.

25 Referring primarily to Figures 1 through 4, an exemplary compound miter saw 10 according to the present invention typically includes a base assembly 12, including

a table assembly 13, which is preferably rotatable in order to accommodate the various cutting modes discussed below. The saw 10 also includes a saw blade 14, at least partially enclosed by a blade guard 16 and driven by a motor 17, and a handle 18, which allows the operator to move the saw blade 14 and the blade guard 16 from a clear
5 position free of a workpiece 11 to a cutting position with the saw blade 14 in cutting engagement with the workpiece 11.

As is conventional in this type of equipment, a fence assembly, indicated generally by reference numeral 20, is interconnected with the base 12 and extends laterally across the table assembly 13, against which the workpiece 11 is fixedly
10 positioned and supported for performing a cutting operation thereon. According to the present invention, the fence assembly 20 includes a fixed fence portion 22 and a movable fence portion 24, with the fixed and movable fence portions 22 and 24, respectively, extending in a mutually aligned lateral direction, with the movable fence
15 portion 24 being laterally spaced away from the fixed fence portion 22. Such lateral spacing or gap between the fixed and movable fence portions 22 and 24, respectively, provides clearance for the saw blade to perform a cutting operation completely through the workpiece 11, regardless of the mode or type of cutting operating being performed.
As is discussed in more detail below, the movable fence portion 24 is laterally movable toward and away from the fixed fence portion 22 in order to allow the operator to
20 selectively adjust the clearance gap therebetween and thus accommodate the particular cutting operation being performed.

As is schematically illustrated in Figures 5 and 6, the exemplary compound miter saw 10 depicted in the drawings is capable of a number of different cutting modes or positions. In Figure 5, a schematic plan view generally illustrates the position of the saw
25 blade 14 relative to the frame 12 and the fence assembly 20 when performing straight cross-cut or so-called straight miter-cutting operations. Such straight, square, cross-cut

cutting operation is schematically illustrated by the position of the components of the compound miter saw 10 shown in solid lines in Figure 5, with the movable fence portion 24 having been selectively adjusted to provide the minimum required clearance gap between the fixed and movable fence portions 22 and 24, respectively, with the saw blade being moved into the cutting position along a single, vertical plane, substantially perpendicular to both the front face of the fence assembly 20 and the upper face of the table 13. In contrast, an exemplary miter-cutting operation is also schematically illustrated in phantom lines in Figure 5, in which the plane of movement of the saw blade 14 remains perpendicular to the table 13, but is swung to a preselected miter angle relative to the fence assembly 20, as indicated by reference numeral 14a, and in which the movable fence portion 24 has been preselectively adjusted, as indicated by reference numeral 24a, to increase the clearance gap between the fixed and movable fence portions 22 and 24a, respectively, in order to provide sufficient clearance for the saw blade 14a and associated components in a miter-cutting position.

Similarly, Figure 6 illustrates the saw blade 14 and the movable fence portion 24 in a schematic elevational view, showing the position of the saw blade 14 and the movable fence portion 24 in solid lines for performing the above-described straight, square, cross-cutting operation, with the relative positions of the saw blade 14 and the movable fence portion 24 being shown in phantom lines, as indicated by reference numerals 14b and 24b, respectively, for performing a different type of mitering operation wherein a bevel cut is performed on the workpiece, with the plane of movement of the saw blade 14b being generally perpendicular to the face of the fence assembly 20, but oriented at a bevel or miter angle with respect to the table assembly 13.

Although not specifically illustrated in the drawings, one skilled in the art will readily recognize, from the exemplary positions dramatically illustrated in Figures 5 and 6, that the miter-cutting operation can be combined with the bevel-cutting operation in

order to perform an operation commonly known as a compound cut, wherein the saw blade moves in a plane that is not perpendicular to either the front of the fence assembly 20 or the upper face table assembly 13, thus performing a beveled and mitered, or "compound mitered", cut through the workpiece.

5 Thus, the compound miter saw 10 shown for purposes of illustration in the drawings is capable of at least four general types of cutting operations, to which reference is made herein as cross-cutting, miter-cutting, bevel-cutting and compound cutting operations. Such typically infinite compound adjustability of the relative position and orientation of the saw blade relative to both the table assembly 13 and the fence
10 assembly 20 is accomplished by way of a compound pivot mechanism 34, illustrated generally in Figures 3 and 4. Such compound pivot mechanism 34 can be any of a number of well-known compound mechanisms, which also allow the saw blade 14 and the blade guard 16 to be pivotally moved from a raised, clear position to a lowered or cutting position, once the saw is adjusted to the desired operating mode, in order to
15 perform a cutting operation on the workpiece 11.

 In order to accommodate the widely divergent positions and orientations of the saw blade 14 relative to the fence assembly 20, and in order to allow a complete cut-through operation to be performed on the workpiece 11, the fence assembly 20 must be capable of selective adjustment in order to preadjust the lateral clearance gap or
20 spacing between the fixed and movable fence portions 22 and 24, respectively, in order to provide the required clearance, while still providing adequate support for the workpiece 11. In accordance with a preferred form of the present invention, such fence assembly adjustability is accomplished in part by the provision of a fence-supporting portion 26 of the base 12. The fence-supporting portion 26 can be a separate
25 component, fixedly secured to the base 12, or it can be an integral portion of the fixed fence 22, with an interconnecting portion 27 extending laterally across the clearance

gap, behind the fixed and movable fences to the opposite side of the saw blade to interconnect with the fixed fence 22, as shown in Figures 1, 3 and 5, without interfering with the complete cutting of the workpiece 11. In either arrangement, the fence-supporting portion 26 is fixedly secured to, or interconnected with, the base 12 and is mutually aligned in a laterally-extending direction with the fixed fence portion 22.

As perhaps best seen in Figures 7 and 8, the fence-supporting portion 26 preferably includes a slot 46 defined by a first or front internal wall 48 spaced away from a second or rear internal wall 50, in order to form a space therebetween extending laterally along the movable fence side of the saw blade 14. The movable fence 24 preferably includes an upper portion 40, an intermediate portion 42, a tongue portion 44 slidably received within the slot 46, and a lower face of the intermediate portion 42 slidably engaging the fence-supporting portion 26. The front faces of the fence-supporting portion 26 and the movable fence portion 24 are vertically aligned and flush with one another, as is illustrated in Figures 7 and 8.

In order to secure the movable fence portion 24 in a preselected, adjusted position for purposes of performing a desired cutting operation, two clamping arrangements are preferably provided for releasably fixing the position of the movable fence portion 24 relative to the fence-supporting portion 26, with their front faces flush and vertically aligned. The fixed clamping mechanism preferably includes a clamping screw 54 threadably engaging and movable within a threaded opening 56 in the fixed fence-supporting portion 26. The clamping screw is selectively rotatable by way of a manual knob 55 in order to threadably advance the clamping screw 54 toward the tongue 44 and to clampingly and forcibly urge the tongue 44 against the front internal wall 48 of the slot 46, as shown in Figure 7.

A movable clamping mechanism is also preferably provided, as is illustrated in Figure 8, and a recessed portion 60 of the movable fence 24 is provided to

accommodate a clamping plate 62 disposed on the rear side of the movable fence 24. The clamping plate 62 preferably includes an abutment portion 64, extending into the slot 46, which is selectively pivotally movable into abutment with the rear internal wall 50 of the slot 46, by way of the pivotal engagement of the clamping plate 62 about a fulcrum edge 68 of a shoulder portion 66 formed on the fence-supporting portion 26. The abutment portion 64 of the clamping plate 62 is held in its abutting relationship with the rear internal wall 50 of the slot 46 preferably by way of a threaded rod member 72 fixed on the movable fence portion 24, and extending through an opening 71 in the clamping plate 62 to threadably engage a locking nut 74, preferably having a knob 75 on the locking nut 74.

Thus, by threadably tightening the locking nut 74, the operator forcibly urges the locking portion 70 of the clamping plate 62 toward the movable fence portion 24, which results in the abutment portion 64 of the clamping plate 62 being pivoted rearwardly about the fulcrum edge 68 in order to abuttingly and forcibly engage the rear internal wall 50 of the slot 46. As a result of this forcible abutting engagement of the abutment portion 64 against the rear internal wall 50 of the slot 46, a reactive force is exerted on the movable fence portion 24 in a frontward direction to forcibly and clampingly urge the tongue 44 against the forward internal wall 48 of the slot 46, thus releasably and securely clamping the movable fence 24 in its preselected lateral position relative to the fixed fence 22.

This arrangement allows for example, the lateral distance between the above-discussed fixed and movable clamping arrangements to be at its maximum when the movable fence 24 is adjusted to provide the minimum clearance gap, such as would be desired in straight cross-cutting operations, such as that shown in Figure 1. This gives the greatest amount of uniform clamping distribution for releasably securing the movable fence 24 in this position, which in turn provides the maximum amount of

support for the workpiece 11. However, the fence assembly of the present invention allows both the clamping arrangements to be used even when the movable fence 24 must be positioned laterally farther away from the fixed fence portion 22 in order to accommodate other cutting modes. This is because the above-described clamping plate arrangement is interconnected and movable with the movable fence 24. It can readily be seen that if both clamping arrangements had been fixed relative to the fence-supporting portion 26, many outwardly adjusted positions of the movable fence 24 would result in only one of the clamping arrangements being usable to secure the movable fence 24 in its adjusted position, thus increasing the possibility of misalignment either vertically or laterally with the fixed fence 22 and lessening the work-supporting capabilities of the fence assembly 20. The fully retracted position of the movable fence 24 is shown in solid lines in Figure 6, with the fully extended position (indicated by reference numeral 24c) is shown in phantom lines.

15 *Feb 81* In order to minimize the possibility of inadvertent removal of the movable fence 24 from the table 13 and the frame 12 during position adjustments, the front face of the tongue 44 is preferably provided with an elongated antiremoval groove or slot 80 extending laterally therealong, as shown in Figures 7 and 9. A complementary projection 82 is fixed to the fence-supporting portion 26 and protrudes into the slot 46 to be received in the antiremoval groove 80. As perhaps best seen in Figure 9, the lateral length of the groove 80 is sufficient to allow full adjusting movement of the movable fence 24 but insufficient to allow inadvertent removal of the movable fence 24. In addition, the clamping plate 62 also interferes with removal of the movable fence 24 unless the clamping plate 62 is first loosened.

When it is desired to intentionally remove the movable fence 24 for repair, replacement or cleaning, however, the fixed clamping screw 54 (see Figure 7) can be

sufficiently loosened, and the clamping plate 62 (see Figure 8) is loosened, allowing the movable fence 24 to be removed.

Since the movable fence 24 must be movably adjusted in order to allow the operator to perform various cutting operations of the compound miter saw 10, damage to the movable fence 24 could result if the operator fails to properly adjust its lateral position. In order to minimize such damage, which could result from the saw blade 14 contacting a misadjusted movable fence 24, a raised portion 32 is formed generally at the saw blade end of the movable fence 24, with the edge of such raised portion 32 sloping generally downwardly toward the saw blade 14 and the table assembly 13. Such raised portion 32 is sized and configured, as is schematically illustrated in Figure 9, so that it interferingly engages the blade guard 16 if the blade guard 16 and the saw blade 14 are moved from their clear position to their cutting position when in substantially all of the cutting set-up modes or configurations of which the compound miter saw 10 is capable.

In addition, as can be seen in Figures 1 through 3, the raised portion 32 of the movable fence 24, along with one or more raised portions 28 and 30 on the fixed fence 22, provide an increased vertical workpiece-supporting face or surface, which allows the operator to properly support a relatively tall or thick workpiece. Such increased-height workpiece-supporting capability is especially advantageous when cutting thick stock, crown moldings, or other such relatively tall workpiece shapes, orientations, or configurations.

FIG 10 schematically illustrates the provision of a laterally adjustable movable fence portion on each lateral side of an exemplary compound miter saw according to the invention. Such dual movable fence provision accommodates movement to selective miter, bevel, and compound cutting operations on either lateral side of the compound miter saw. Similarly, such an arrangement is advantageous in other work-

performing devices where work operations can be performed on either lateral side of the device, as well as being capable of accommodating large working tools, such as large shaper cutters, for example.

In such alternate arrangement, as schematically illustrated in Figure 10, each lateral side of an exemplary compound miter saw 110 includes a fence-supporting portion 126 for slidably supporting a movable fence portion 124, with these components, as well as their respective fixed and movable clamping arrangements, being essentially the same in configuration and function as those discussed above, but preferably arranged symmetrically, in a mirror-image configuration on opposite sides of the saw blade 114.

Accordingly, the exemplary compound miter saw 10 constructed in accordance with the principles of the present invention provides for increased ease of fence clearance gap adjustability, it facilitates proper fence alignment and securement, both vertically and laterally, when performing any of the widely divergent cutting operations for which the compound miter saw 10 is designed, it provides increased protection against inadvertent damage due to a nonadjusted or misadjusted fence, and it provides greatly improved workpiece-supporting capabilities for relatively thick or tall workpieces.

The foregoing discussion discloses and describes merely exemplary embodiments of the present invention for purposes of illustration only. One skilled in the art will readily recognize from such discussion, and from the accompanying drawings and claims, that various changes, modifications, and variations may be made therein without departing from the spirit and scope of the invention as defined in the following claims.